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Memorandum

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Steve Grice, USA
Russell Herrscher, USA

Date: September 15, 2015

Project: 32820012

Subject: St. Louis Tunnel Water Level Monitoring Status Report
Rico-Argentine Mine Site, Dolores County, Colorado

This memorandum describes the current water level monitoring results and flow conditions for the St. Louis Tunnel, located at the Rico-Argentine Mine Site (site), as well as the scope of work anticipated for lowering water levels behind the collapsed St. Louis Tunnel portal.

BACKGROUND

The St. Louis Tunnel is an historic mine tunnel that was driven into the toe of the western slope of Telescope Mountain. The tunnel connects to and drains water from a system of hard rock mining tunnels, shafts, stopes, and raises. The St. Louis Tunnel originally was driven into bedrock and included a timber-frame structure that provided access through overlying alluvium/colluvium. Today, this timbered portion of the tunnel is largely collapsed. Water now flows through an un-engineered, alluvium/colluvium plug upgradient of the historic portal, along an unlined channel through collapsed timbers within the former tunnel, to a lined channel, and then through one of multiple diversion pipes and demonstration-scale treatment systems to a series of settling ponds. Ultimately, flow from the St. Louis Tunnel discharges through the settling ponds to the Dolores River.

In 2011, angled borings were drilled and monitoring wells BAH-01 and AT-2 were installed upgradient of the collapsed portion of the St. Louis Tunnel to assess the flow conditions within the non-collapsed portion of the tunnel. Monitoring well AT-2 penetrates the tunnel about 30 feet inby the tunnel plug and about 30 feet outby the colluvium/bedrock contact. Monitoring well BAH-01 penetrates the tunnel about 75 feet inby AT-2 (Attachment 1), within the bedrock portion of the tunnel and likely upstream of any collapsed section. BAH-01 has a significantly longer completion (250 feet) than AT-2.

Water levels in both wells have been measured manually since their installation. Additionally, a pressure transducer has provided near-continuous water level measurements at AT-2 since

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2011. The AT-2 pressure transducer was recently connected to the Former Lime Treatment Plant SCADA system and calibrated to elevation. The SCADA system provides 24/7 real-time water level monitoring. An example, real-time plot of AT-2 pressure transducer data versus time is provided in Attachment 2.

MONITORING DATA

Data collected to date from AT-2 and BAH-01, along with flow rates measured at monitoring location DR-3, are plotted as time series (Attachment 3) and flow regressions (Attachment 4). These data include both manually measured and data-logged transducer data. Note that water levels in BAH-01 prior to 2014 are not considered to be reliable due to measurement technique and therefore were omitted from Attachment 4. Due to uncertainty in the casing course and elevation, water levels in BAH-01 may be considered to have an error of up to +/- four feet. Installation of a new pressure transducer, as described later in this memorandum, is intended to improve measurement accuracy.

Water levels have been rising within the non-collapsed portion of the St. Louis Tunnel, as measured at AT-2, during recent years. During spring runoff periods, water levels appear to increase more rapidly. Water levels rose from approximately 8,860 feet above mean sea level (amsl) in early 2014 to 8,863 feet amsl in early 2015 and nearly 8,865 feet amsl as of August 2015 (Attachment 3). Prior to 2013, AT-2 head response appeared to have been minimal with respect to flow. In 2014 and 2015, AT-2 water level appeared to develop a linear relationship to flow quantity, indicative of a Darcian flow regime through the debris plug (Attachment 4).

Based on prior adit flow modeling and current data, the peak flow to date in 2015 appeared to occur approximately three weeks ago (Attachments 2 and 3). AT-2 water levels and DR-3 flow rates have begun to drop and are expected to continue to drop until spring 2016.

Preliminary data from BAH-01 indicate that head is higher at BAH-01 than at AT-2 and appears to follow similar flow characteristics. This likely indicates additional blockage between AT-2 and BAH-01. However, due to the length of BAH-01 and the potential for wander during drilling, the profile of BAH-01 and tunnel head at the penetration of BAH-01 are currently uncertain.

UPCOMING WORK: BAH-01 PRESSURE TRANSDUCER

To improve data collection and water level monitoring at BAH-01, a borehole deviation probe has been acquired to survey BAH-01 and obtain a three-dimensional profile of the well. This information will be used to install and calibrate a new pressure transducer to accurately measure water level in the St. Louis Tunnel at this location. The borehole survey is expected to be completed the week of September 14. The new BAH-01 pressure transducer has been ordered and is expected to arrive to the site the week of September 14. The transducer data will be collected manually from the data recorder initially; connection to the SCADA system will occur shortly thereafter.

UPCOMING WORK: AT-2 SIPHON TEST

A siphon test is being designed to draw down impounded water from behind the collapsed portion of the St. Louis Tunnel. A series of step tests are proposed using the siphon. The siphon will be started and allowed to flow at low flow rates (25 to 50 gallons per minute [gpm]). Then the siphon flow will be shut off, and the water surface within the adit will be allowed to “recover”. The purpose of the step test is to develop a more accurate understanding of the volume of

water stored as open water in the St. Louis Tunnel and within faults and fractures. Lowering this water level also is expected to reduce the static head pressure on the non-engineered alluvium/colluvium plug that currently causes water to impound within the non-collapsed, bedrock portion of the St. Louis Tunnel. During and after drawdown of impounded water to a level closer to base flow levels (i.e., approximately 8,860 feet amsl), water levels will be monitored closely using the AT-2 and BAH-01 pressure transducers to evaluate drawdown and recharge rates.

The scope of work anticipated for the siphon test requires installation of pipe fittings, access port, valves, and a flow meter along the existing high-density polyethylene (HDPE) pipe as well as a well casing for protecting the existing AT-2 pressure transducer (Attachment 5). Installed in 2014, the HDPE pipe connects AT-2 to the Pond 15 flow diversion pipe, located just downstream of the diversion pipe headgate near monitoring location DR-3. Once these modifications are completed, the valve at the downstream end of the HDPE pipe will be closed, the HDPE pipe will be filled with water via the access port near AT-2, and a siphon will be induced to withdraw water from the St. Louis Tunnel via AT-2 by opening the downstream valve.

It is estimated that between approximately 1.5 and 3.5 million gallons of water currently may be impounded behind the collapsed St. Louis Tunnel portal. After the step down tests confirm the siphon can be used to safely drawdown the water surface elevation, the water will be drawn down from an elevation of approximately 8,865 feet to approximately 8,860 feet. This five-foot drawdown is estimated to require siphoning approximately 750,000 gallons of water. At an estimated siphon flow rate of 25 to 100 gpm, this is anticipated to take between five and 21 days.

The siphon flow rate and pressure transducer data output will be monitored as water is siphoned from AT-2 to ensure that a siphon is maintained and to correlate drawdown rate with water level in the non-collapsed portion of the St. Louis Tunnel. Flow rates, flow totals, and water levels will be recorded on data loggers. Depending on the drawdown rate indicated by the pressure transducers, the siphon may be temporarily stopped overnight and/or over weekend(s) by closing the valve at the downstream end of the HDPE pipe or by opening the access port, thereby breaking the siphon. The siphon may be re-induced (primed) by opening the valve or by refilling the HDPE piping if the prime is lost.

ATTACHMENTS

Attachment 1 – Blaine Flow Interception Test Work Plan Figure 3 – St. Louis Tunnel Profile

Attachment 2 – AT-2 Pressure Transducer SCADA System Example Real-Time Plot

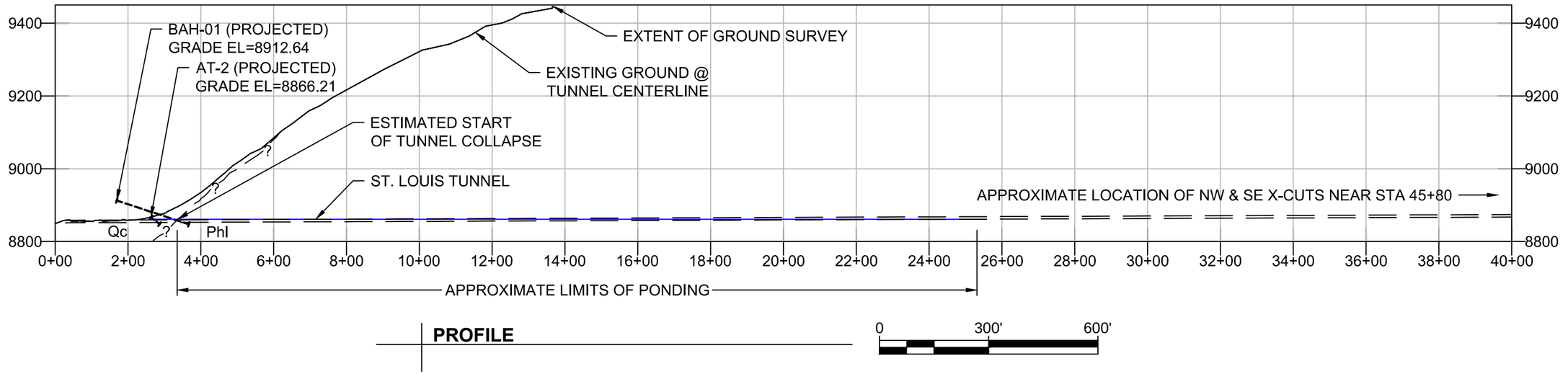
Attachment 3 – St. Louis Tunnel Flow Rates and Water Levels

Attachment 4 – St. Louis Tunnel Water Elevation versus Flow Rate

Attachment 5 – Proposed AT-2 Siphon Design, Draft Figures 1 through 3

ATTACHMENT 1

Blaine Flow Interception Test Work Plan
Figure 3 – St. Louis Tunnel Profile



PROFILE

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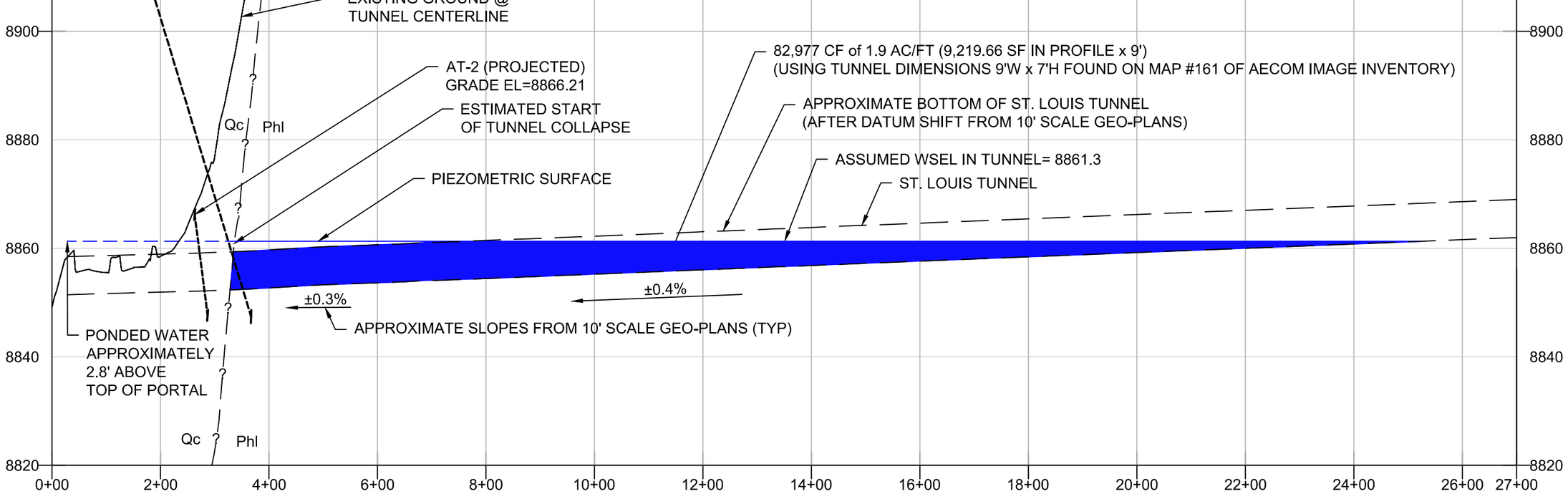


PROFILE - EXAGGERATED

0 100' 200'
0 20' 40'
H: 1" = 200'
V: 1" = 20'

AECOM
APRIL 13, 2012
60239806

PRELIMINARY

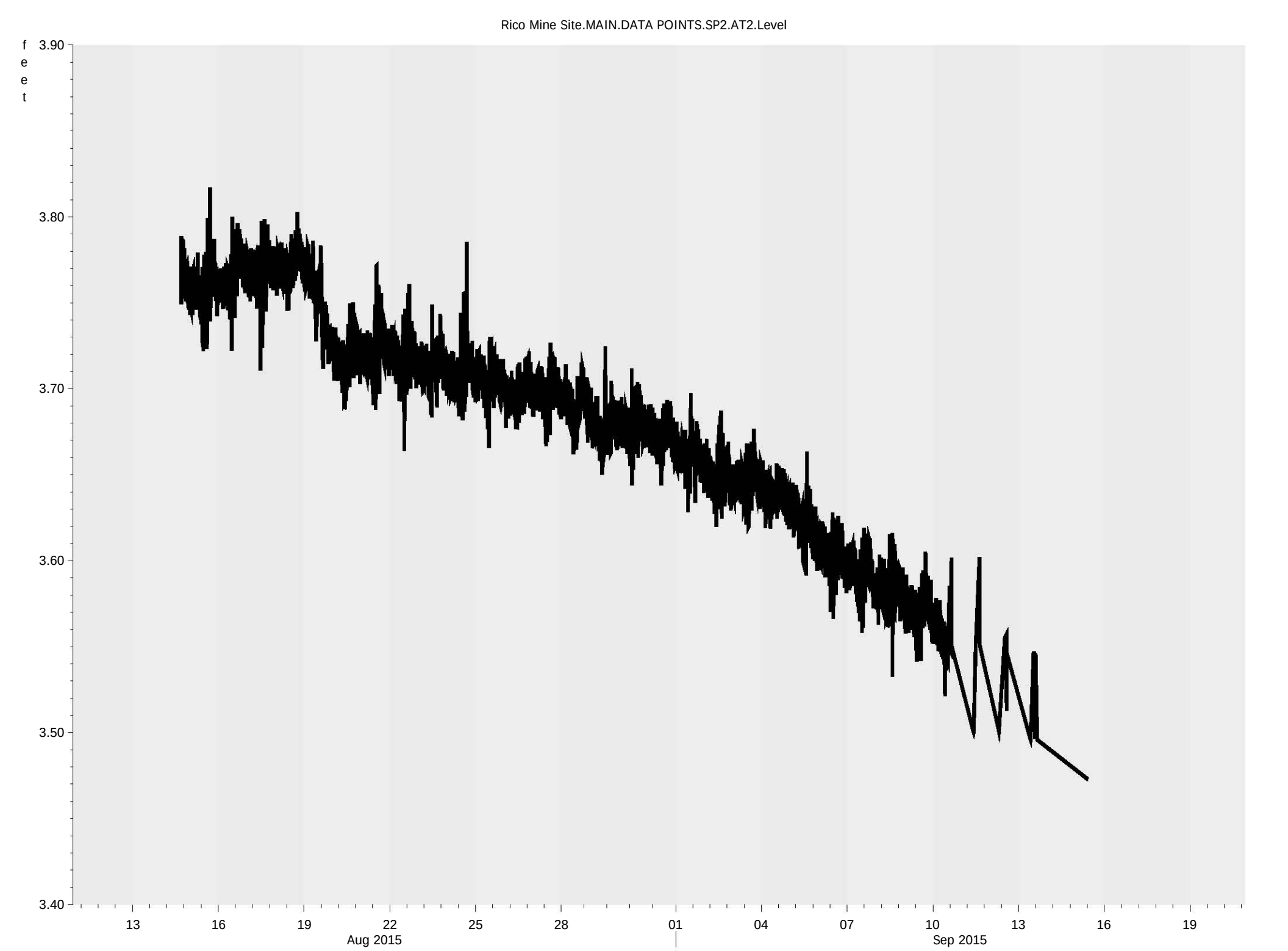
RICO-ARGENTINE SITE-OU01

BLAINE FLOW INTERCEPTION TEST WORK PLAN

FIGURE 3 - ST. LOUIS TUNNEL PROFILE

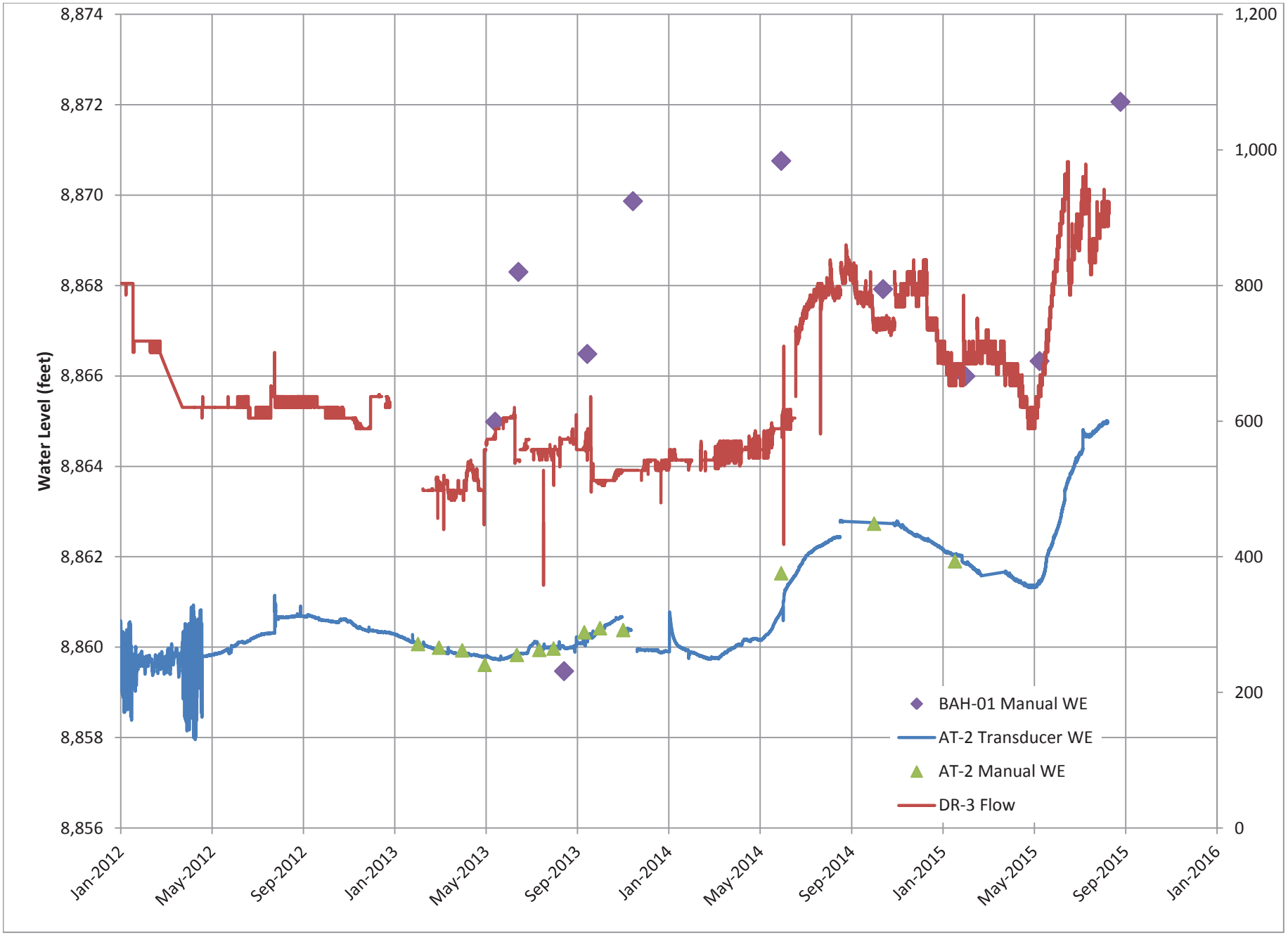
ATTACHMENT 2

AT-2 Pressure Transducer SCADA System
Example Real-Time Plot

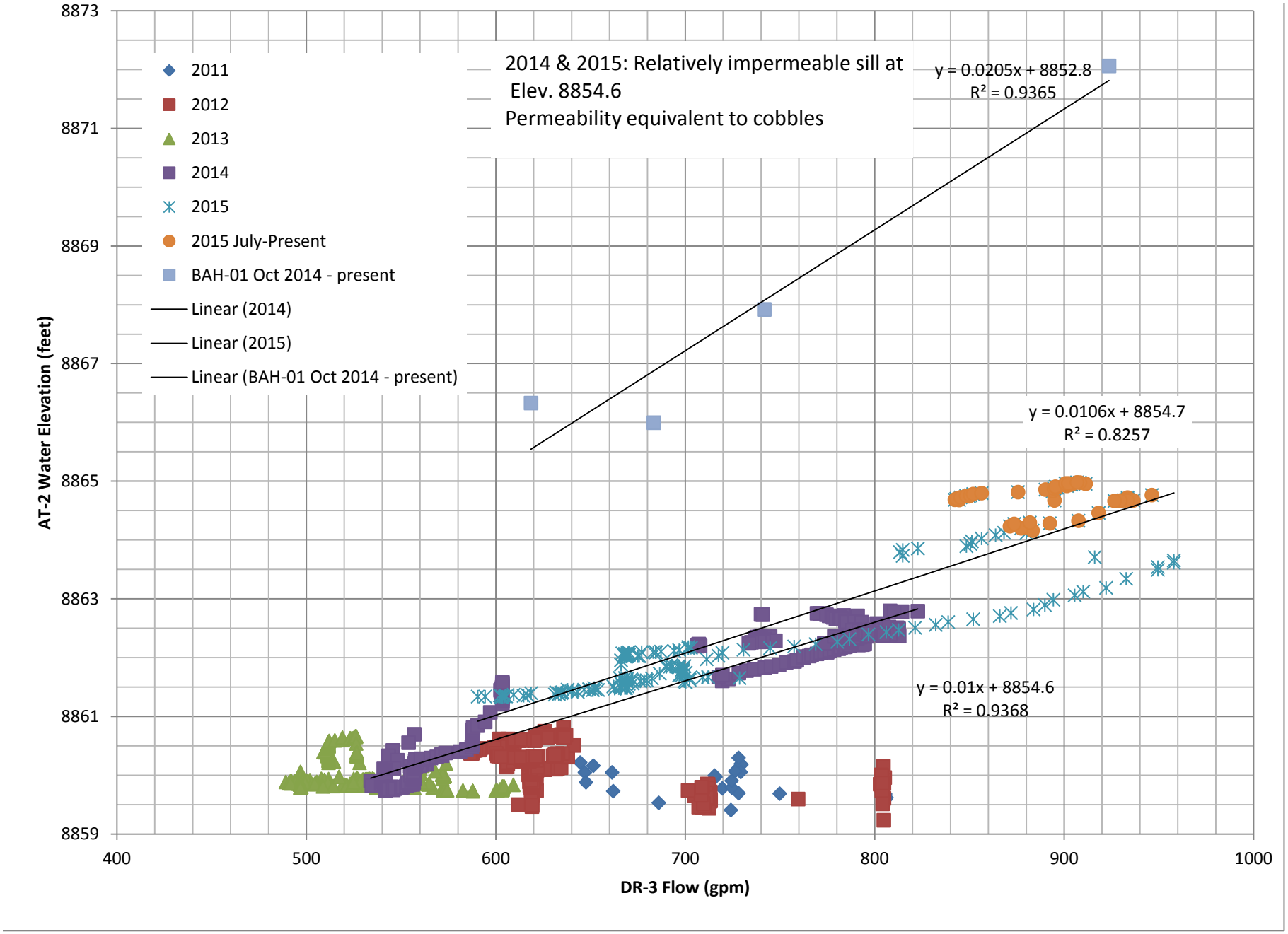


Trace	Type	Ruler
Rico Mine Site.MAIN.DATA POINTS.SP2.AT2.Level	Processed Historic	-

Attachment 3 - St. Louis Tunnel Flow Rates and Water Levels



Attachment 4 - St. Louis Tunnel Water Elevation versus Flow Rate

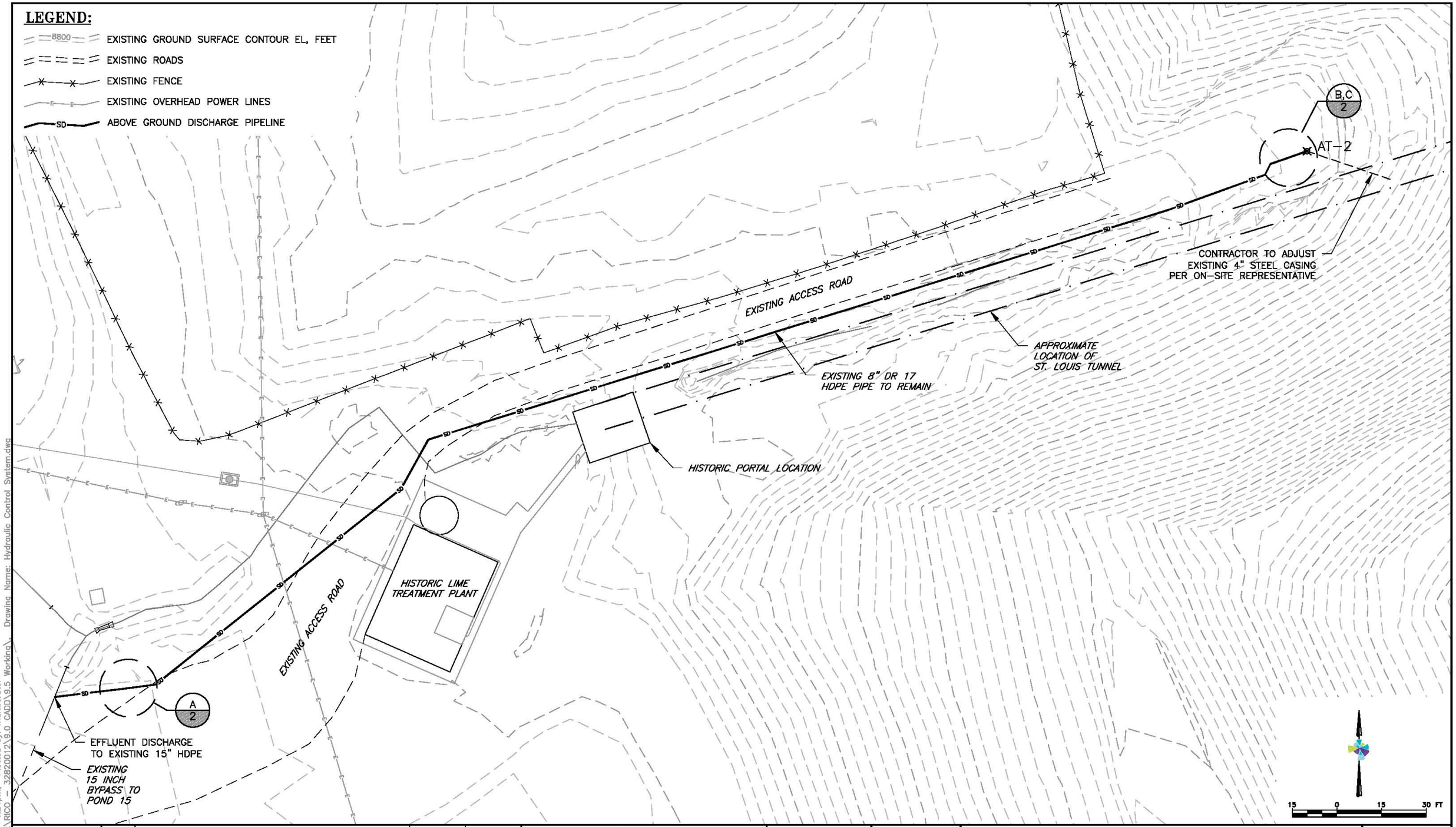


ATTACHMENT 5

Proposed AT-2 Siphon Design
Draft Figures 1 through 3

LEGEND:

- 8800 — EXISTING GROUND SURFACE CONTOUR EL, FEET
- EXISTING ROADS
- EXISTING FENCE
- EXISTING OVERHEAD POWER LINES
- SD — ABOVE GROUND DISCHARGE PIPELINE



REFERENCES:	NO.	REVISION	DATE	APRVD
PLANS: PLAN SET	0	ISSUED FOR CONSTRUCTION	9/4/15	CBF
DATUM: UTM ZONE 125 FEET, NAD 83				

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DRAWN BY:	MGC
DESIGNED BY:	MED
CHECKED BY:	CBF
REVIEWED BY:	CBF

PROJECT: **RICO-ARGENTINE MINE SITE ENHANCED WETLAND DEMONSTRATION**

TITLE: **AT-2 SIPHON PLAN**

ISSUED DATE:	8/27/15
PROJECT No:	32820012
REV.	0
SHT No.	1

Plot Date: 09/03/15 - 4:24pm Plotted by: mark.crater
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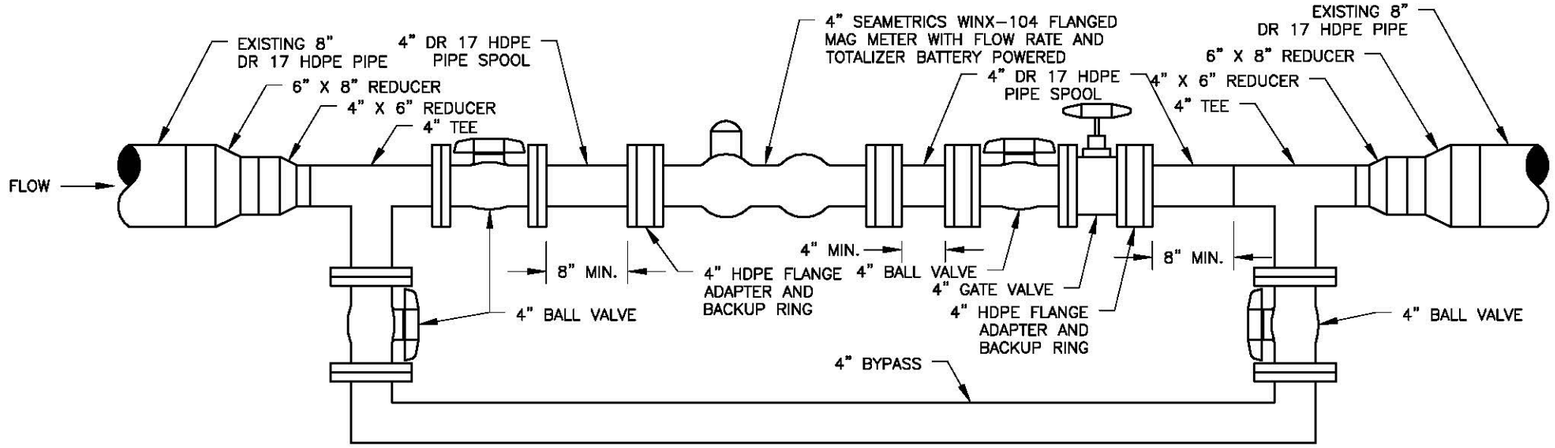
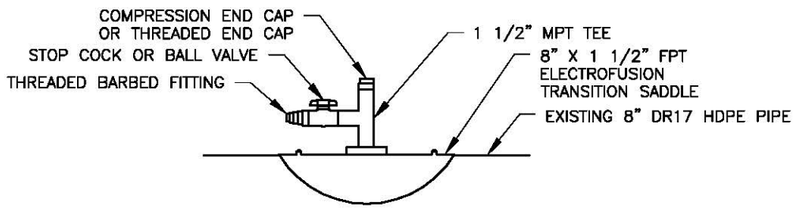
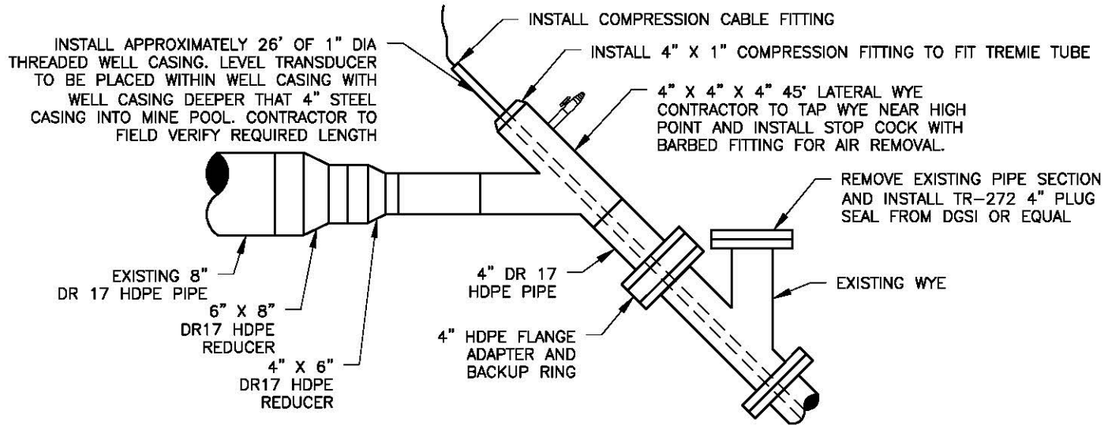


A/1 PIPING DETAIL



B/1 PIPING DETAIL

NOTE: CONTRACTOR TO INSTALL DOWNSTREAM OF DETAIL C TO FILL PIPING WITH WATER AND INDUCE SIPHON.



C/1 PIPING DETAIL

NOTE: CONTRACTOR TO INSTALL HDPE BENDS AS NECESSARY TO CONNECT TO EXISTING PIPING.

REFERENCES:	NO.	REVISION	DATE	APRVD
PLANS: PLAN SET	0	ISSUED FOR CONSTRUCTION	9/4/15	CBF
DATUM: UTM ZONE 125 FEET, NAD 83				

amec foster wheeler

DRAWN BY:	MGC
DESIGNED BY:	MED
CHECKED BY:	CBF
REVIEWED BY:	CBF

PROJECT: **RICO-ARGENTINE MINE SITE ENHANCED WETLAND DEMONSTRATION**

TITLE: **AT-2 SIPHON DETAILS**

ISSUED DATE:	8/27/15
PROJECT No:	32820012
REV.	0
SHT No.	2

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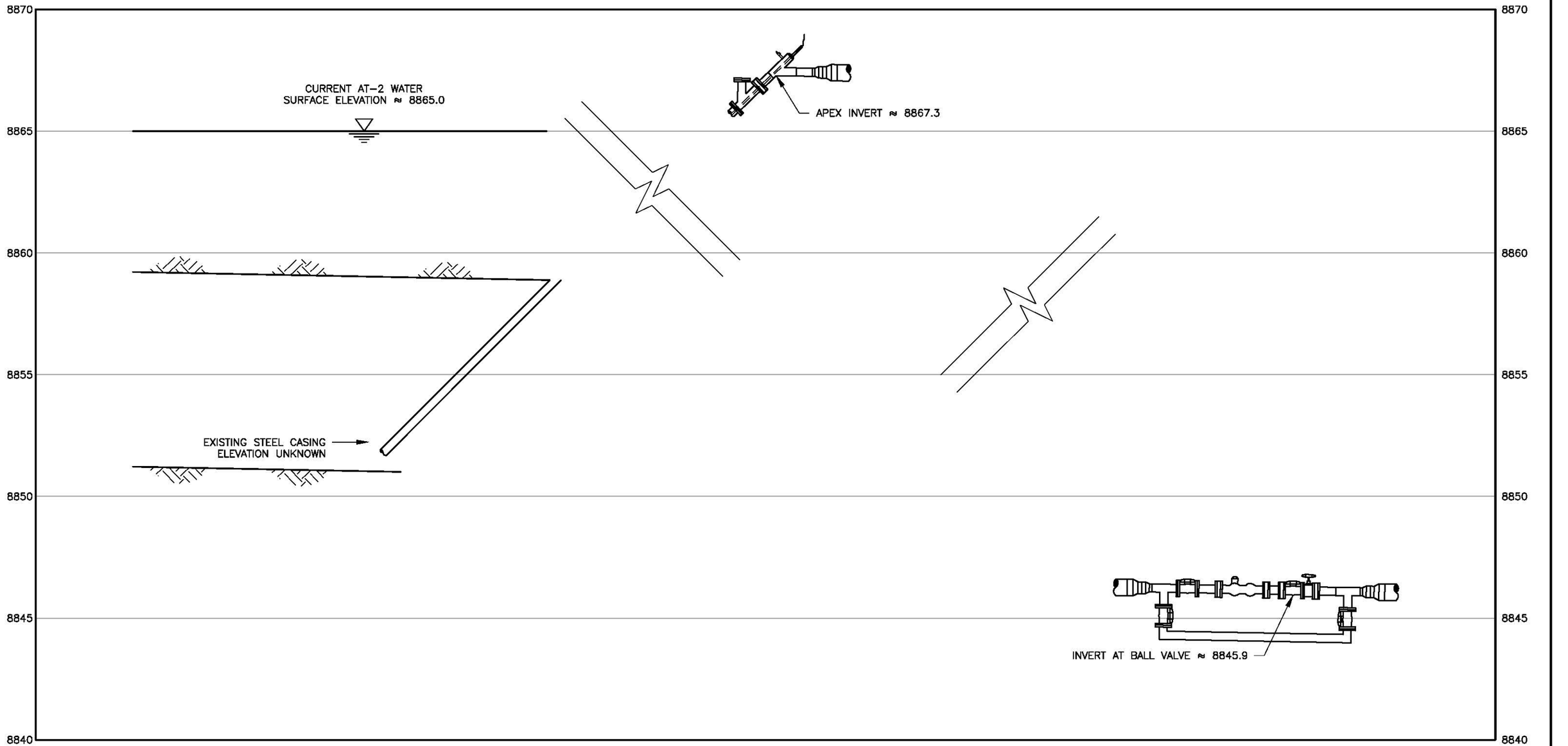

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REFERENCES:
PLANS:
PLAN SET

DATUM:
UTM ZONE 125
FEET, NAD 83

NO.	REVISION	DATE	APRVD
0	ISSUED FOR CONSTRUCTION	9/4/15	CBF

amec foster wheeler

DRAWN BY: MGC
DESIGNED BY: MED
CHECKED BY: CBF
REVIEWED BY: CBF

PROJECT: **RICO-ARGENTINE MINE SITE ENHANCED WETLAND DEMONSTRATION**

TITLE:

AT-2 SIPHON PROFILE

ISSUED DATE: 8/27/15
PROJECT No: 32820012
REV. 0
SHT No. 3